

Jet substructure plots for QM

Dennis and Rosi
JS Topical Group conveners

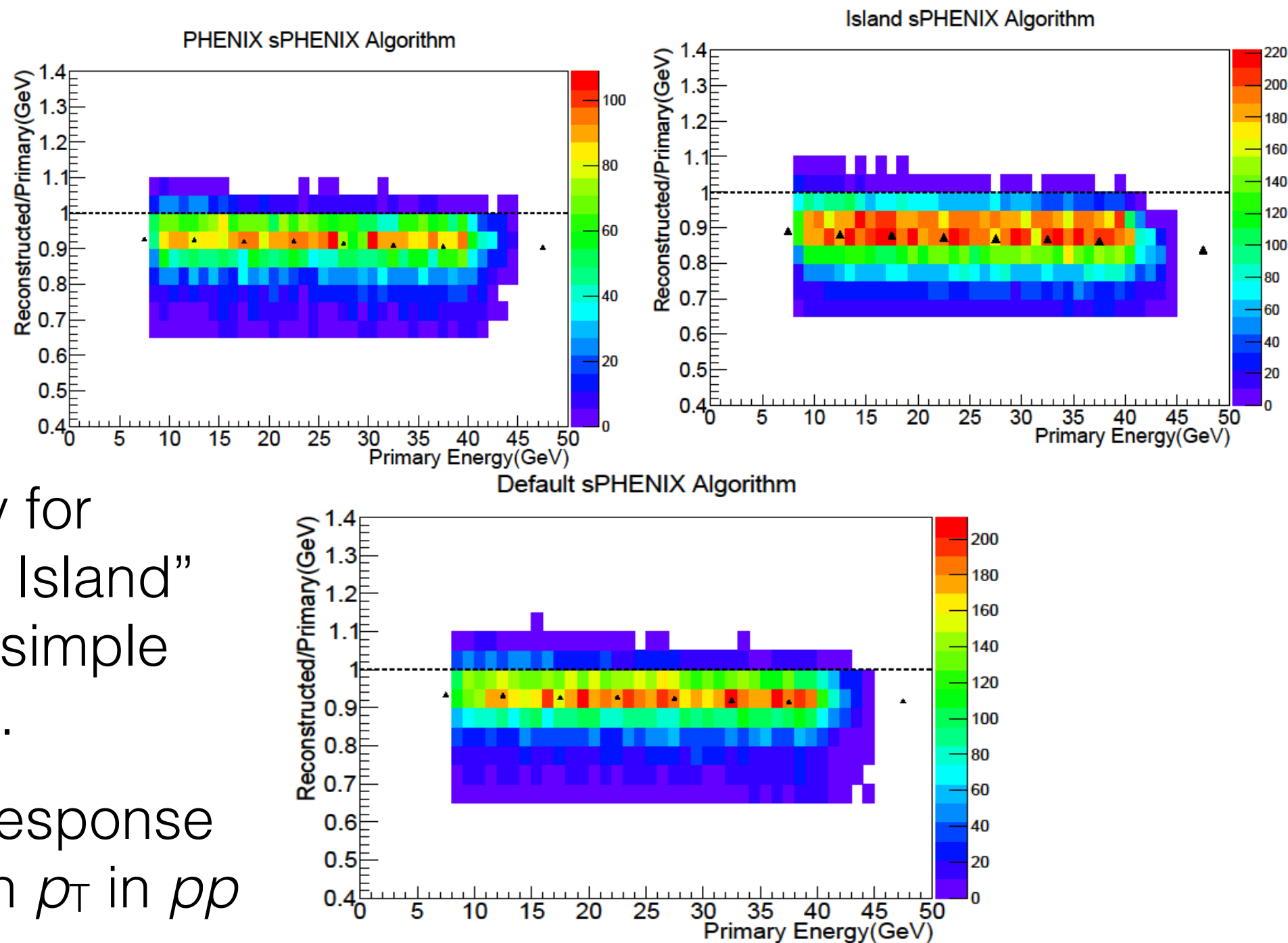
27 January 2017
sPHENIX General Meeting

Status of QM plots

- In December, proposed to make a common set of photon+jet events ($p_T^\gamma > 30$ GeV) and ask TG members to examine different aspects:
 - ➔ photon performance, jet performance, tracking performance
- Identified analyzers to work on some of these, with good progress (and discovered non-trivial performance issues along the way)
 - ➔ photon clustering work by Ohio U group
 - ➔ aspects of photon-jet performance in pp by Michigan U
 - ➔ https://wiki.bnl.gov/sPHENIX/index.php/JS_TG_QM17_Plots
- Unfortunately, some technical issues we did not overcome on the QM timescale:
 - ➔ delays in coordinating full embedding simulation
 - ➔ continuing lack of UE subtraction in sPHENIX code base

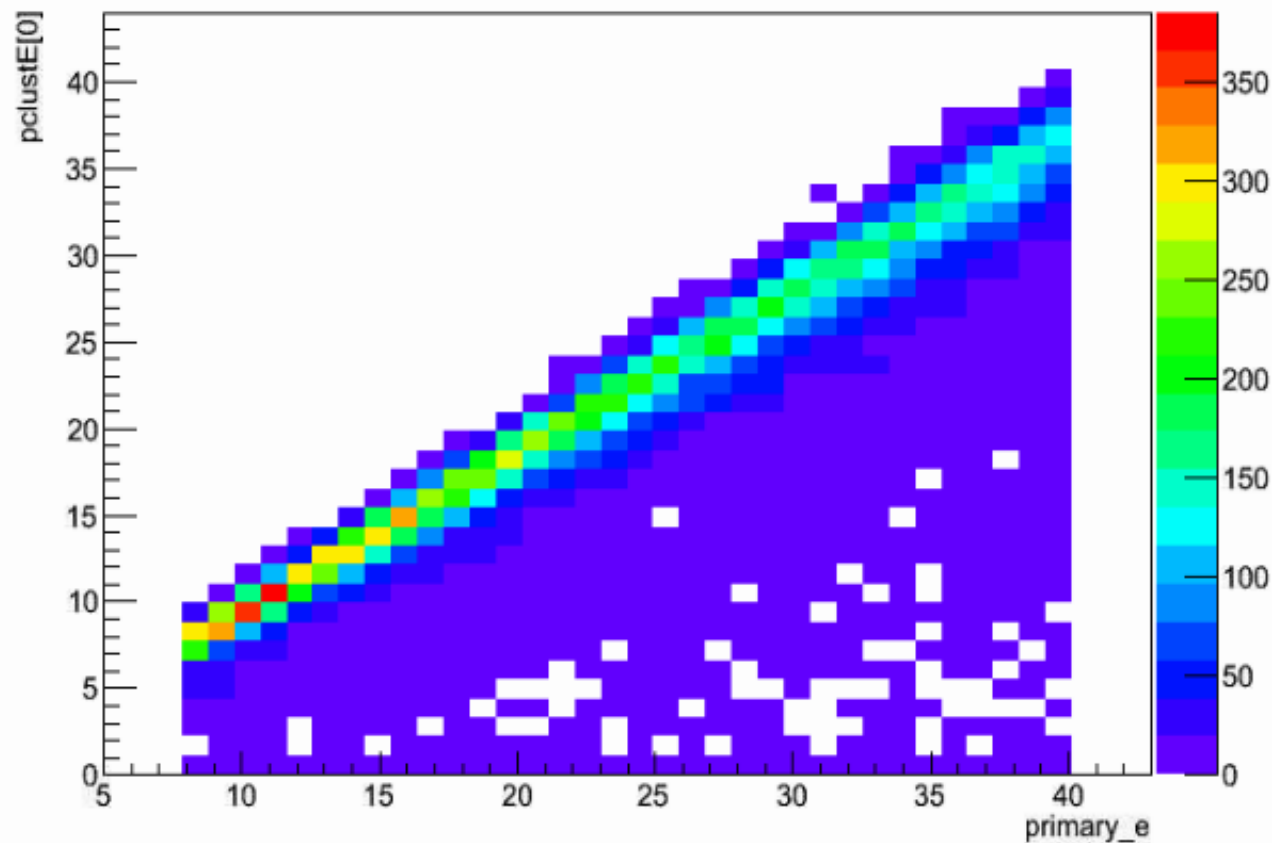
Photon clustering, 1/2

*J. Frantz
A. Pun
T. Danley
(Ohio U)*



- Systematic study for “PHENIX”, “CMS Island” and “sPHENIX” (simple contiguous) algs.
 - ➔ here, energy response vs. true photon p_T in pp
- Have asked analyzers to prepare “nice” 1-D response distributions
 - ➔ also checking in on status of embedded photon studies

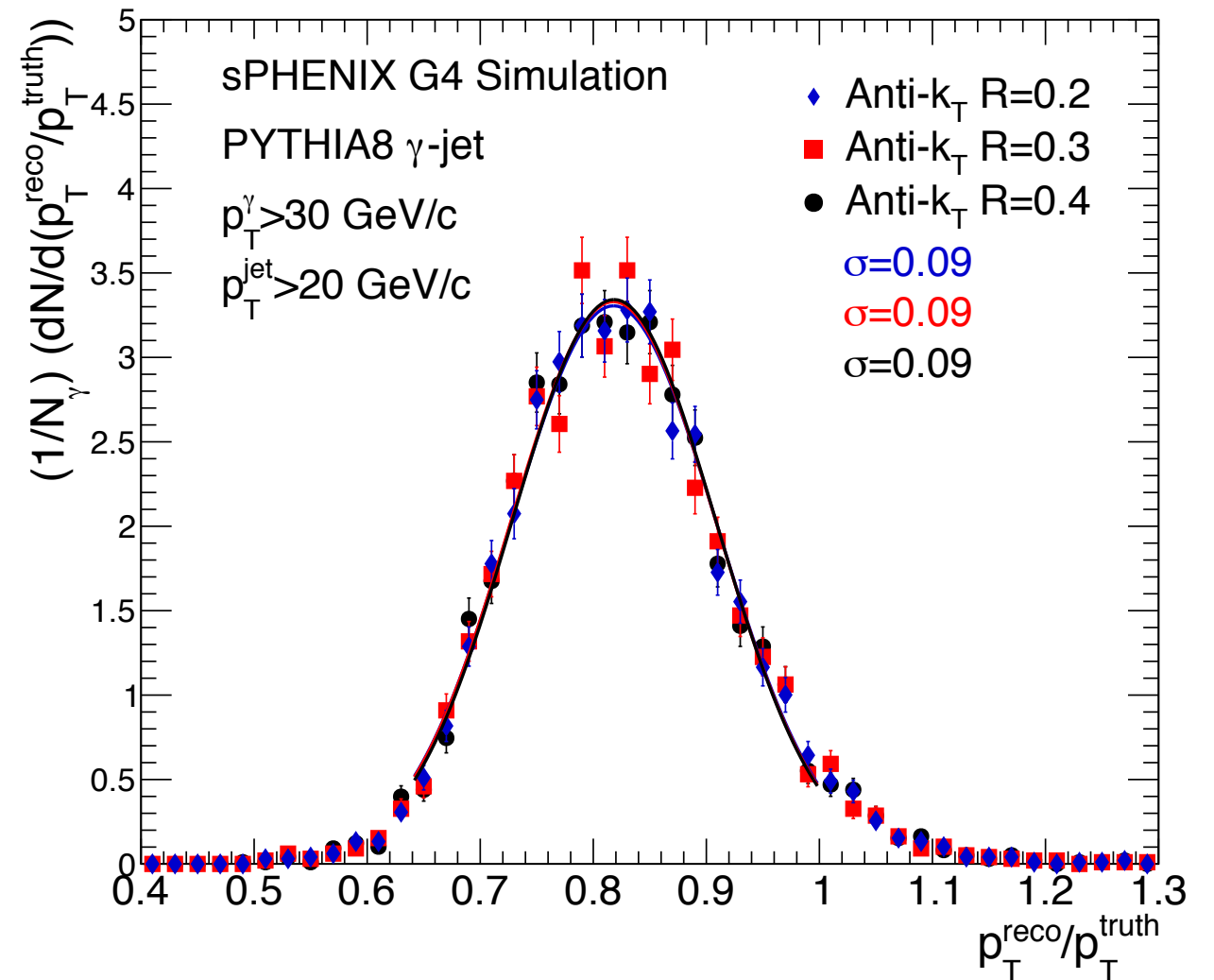
Photon clustering, 2/2



- 2-D scatterplot of true vs. reco photon p_T
 - ➔ low- p_T^{reco} “grass” at level of 4-5%, independent of clustering algorithm
- Recently identified non-trivial fraction of reco photons with only a fraction of incident energy
 - ➔ tend to appear at regular $(\eta^{\text{true}}, \phi^{\text{true}})$ intervals, suggesting that they fall into cracks between towers?
 - ➔ consistent with beam test data & sims? (how big is natural contribution from late-starting showers ($2-3X_0$)? will ask them to follow up...)

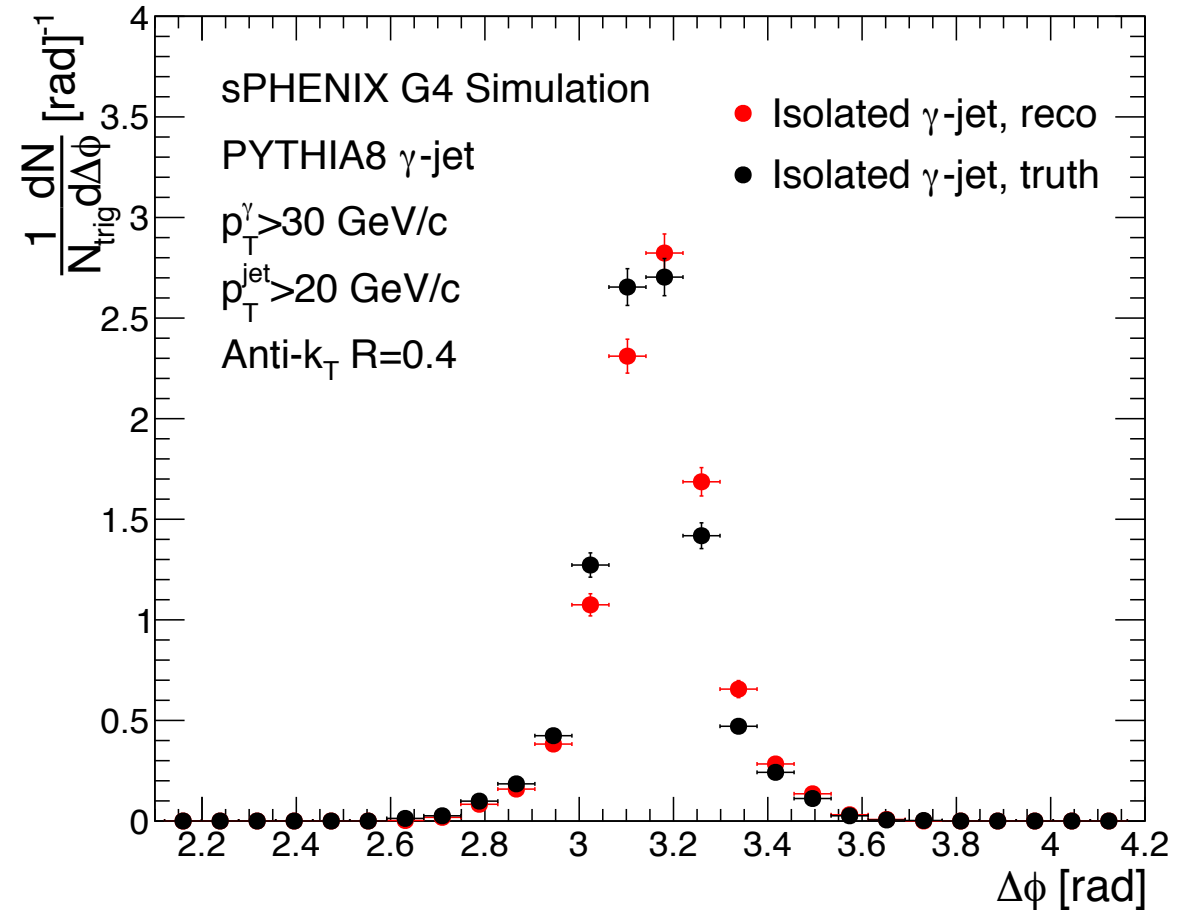
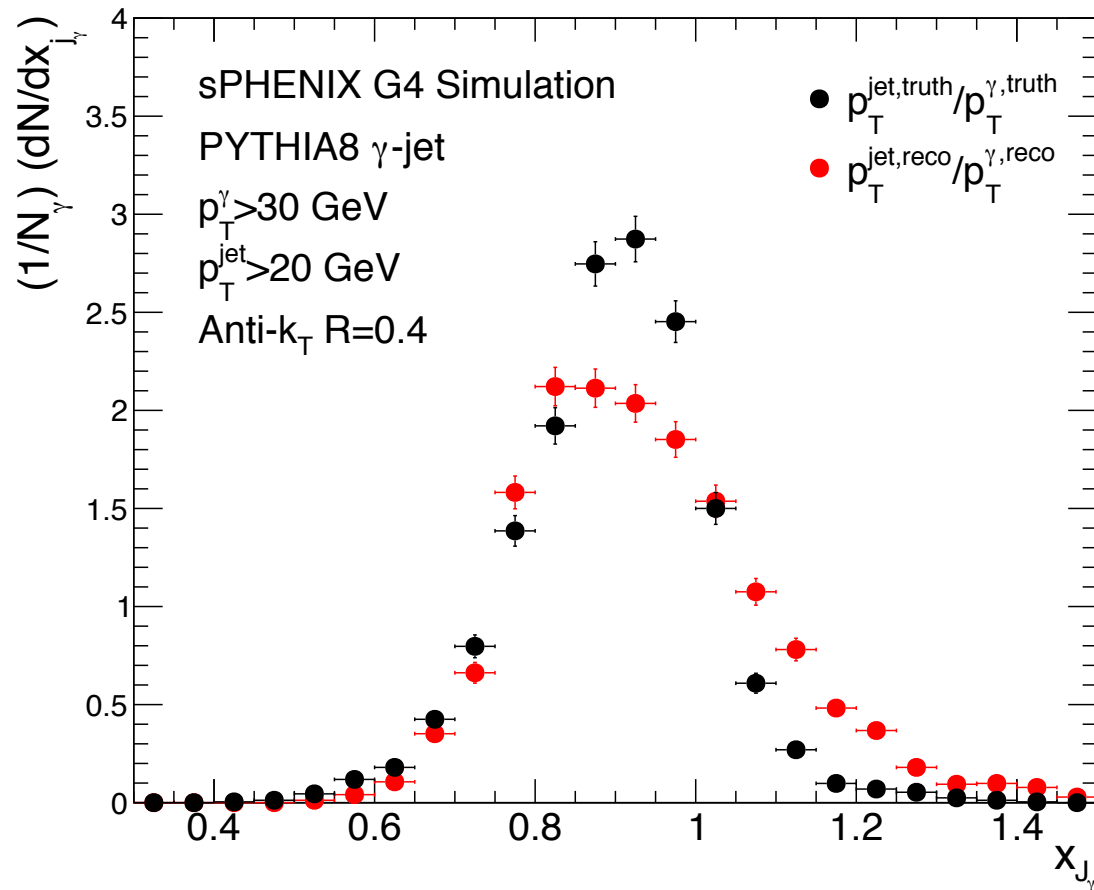
Jet performance, 1/3

*J. Osborn
(Michigan U)*



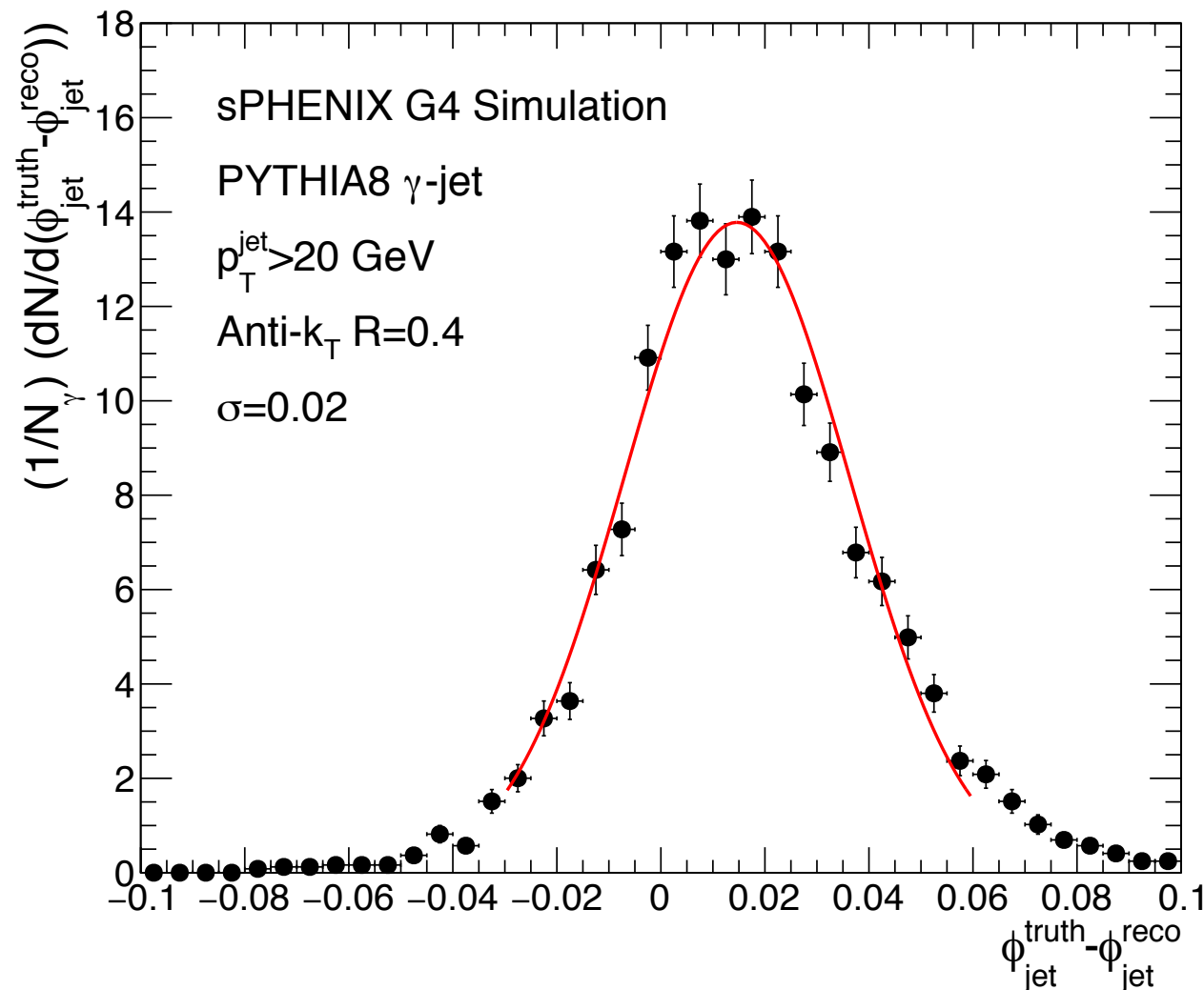
- “Mini-analysis” of photon-jet p_T and angular correlations in pp
 - ➔ at the high-level, reconstructed-object level
 - ➔ including simple isolation criterion
 - ➔ above: response for $R=0.2$, $R=0.3$, $R=0.4$ jets in γ +jet events

Jet performance 2/3



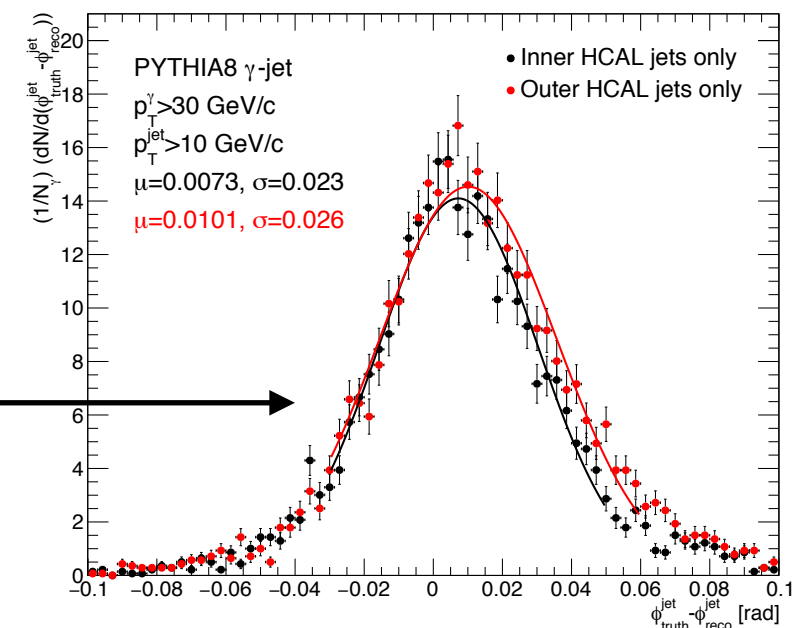
- *Left:* x_{J_γ} distribution at the **truth-** and **reconstructed-**levels
- *Right:* $\Delta\phi^{\gamma+jet}$ at the **truth-** and **reconstructed-**levels
- ➔ together, indicate performance for LHC-style full photon +jet correlation measurements in a pp environment

Jet performance, 3/3



- Systematic shift (“rotation”) of reconstructed jet ϕ position
 ➔ bias arising from assigned ϕ value of (ϕ -tilted) inner & outer HCal towers?

- Has motivated followup studies in Simulations meeting
 ➔ one example (*right*): size of shift for **IHCal**- and **OHCal**-only jets
- ➔ simulations group preparing alternate (rotated) geometries for further tests



Technical issues

- Delays in coordinating full embedding simulation in the last month
 - ➔ several changes necessitating re-simulation
 - ➔ early-Jan for calo updates, mid-Jan for tracking updates
 - ➔ additionally, long simulation time (calorimeter) & reco time (track finding)
 - ➔ $O(1\text{hr})$ per central Au+Au event
 - ➔ given results from HF group on high- p_T tracking in jet-cone, will we just be duplicating effort?
- Continuing lack of UE subtraction in sPHENIX code base
 - ➔ PHJetBackground module did not survive the “PHENIX-sPHENIX” divorce
 - ➔ MIE studies in Au+Au based on this code
 - ➔ obviously, major long-term issue for jet program, no clear manpower
 - ➔ **high-impact, high-priority volunteer opportunity** (esp. useful to have somebody who worked on MIE studies directly!)